



CLIMATE CORPS

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# BUILDING THE CASE FOR SUSTAINABILITY AT THE CITY OF ROCHESTER

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Environmental Defense Fund  
City of Rochester, MN  
EDF Climate Corps 2016  
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## **1. Executive Summary:**

The City of Rochester can improve energy efficiency across its building and lighting portfolios, improve community engagement with sustainability, and establish a green revolving fund to finance projects with \$420,000 annual savings potential through two identified projects by committing to a Sustainability Office. The City is currently lacking a dedicated staff person to identify, plan, and manage projects related to energy efficiency and sustainability. This Sustainability Office would focus on achieving the City's GHG reduction and renewable energy goals, while being responsible for the long-term planning, execution, financing, and verification of energy and sustainability projects for the City of Rochester.

Sustainability Offices have been established in communities across the state of MN including major cities such as Minneapolis, St. Paul & Duluth to smaller towns such as Elk River. Many of these sustainability positions were established in the early-2000's and have implemented Climate and Energy Action Plans, influenced building code and other policy issues related to sustainability, and have tackled energy efficiency projects for their building portfolios. These communities have seen great successes with their sustainability programs, and provide a framework for the City of Rochester to follow.

Rochester is in a unique position to move towards a more sustainable, livable, and vibrant community as they find themselves at the nexus of many large, forward thinking initiatives including the establishment of the Destination Medical Center, the completion of the new Comprehensive Plan, and the growth trajectory of over 50,000 new residents in the next 25 years.

## **2. Background:**

### **2.1. City of Rochester**

The City of Rochester is the third largest city in the state of Minnesota with a population of 111,007 people. Rochester is home to the Mayo Clinic, making it a global destination for nearly 1.5 million visitors each year seeking healthcare services. In recent years, there has been an increase in awareness within the City of Rochester on the importance of energy efficiency and sustainability within city operations. With the passing of the Destination Medical Center bill in 2013, and the updates being made to the City's Comprehensive Plan, Rochester is in a unique position to define sustainability goals for the future. As a result, the Rochester Energy Commission worked in partnership with the consulting firm Wenck to create the Energy Action Plan (EAP) for the city. This comprehensive analysis lays out Rochester's current standing in terms of greenhouse gas emissions and energy usage, and provides measureable action items to follow to propel Rochester into a more sustainable future.

### **2.2. Why Sustainability**

#### **2.2.1. City Goals**

The City of Rochester voluntarily adopted the MN Next Generation Energy Action Goals which are as follows:

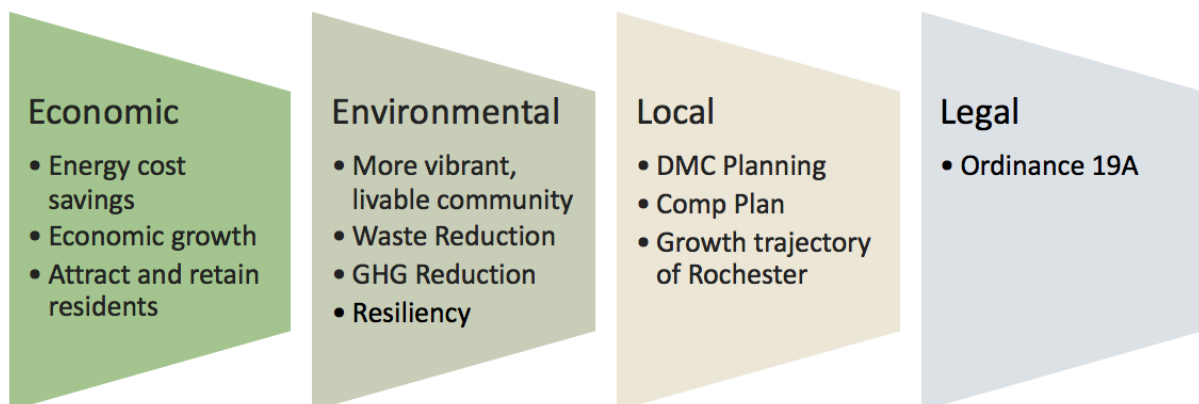
- 1.5% annual retail energy savings
- 25% renewable energy by 2025
- State-wide GHG emission reductions of:
  - 15% GHG reduction of 2005 levels by 2015

- 30% GHG reduction of 2005 levels by 2025
- 80% GHG reduction of 2005 levels by 2050

It is important to note that the Rochester Energy Commission has proposed to normalize these emission goals based on a yet to be determined measure of growth, and that the 2005 baseline will be calculated by using 2014 data and back casting to 2005 in order to ensure the data used for the GHG inventory are as complete and accurate as possible.<sup>1</sup>

In addition, in October of 2015, Mayor Brede signed a proclamation at the Climate Generation Minnesota event held in Rochester. This proclamation stated that the City of Rochester will strive for 100% renewable energy by 2031. In order to meet the GHG reduction goals set by the state of Minnesota, and the City's own personal goal of reaching 100% renewable energy by 2031, the Energy Action Plan was created to help guide the city to those results.

There is a need for formal commitments and partnerships from the City Council, Rochester Public Utilities (RPU), Rochester Energy Commission (REC), City Staff, the community, etc. Implementation of the EAP will need to be carefully planned, monitored, and executed by a dedicated person/s. It is the intent of this report to recommend a formal position be created to oversee the implementation of the EAP, as well as drive the city forward on energy and GHG reduction goals.



### 2.2.2. Energy Efficiency

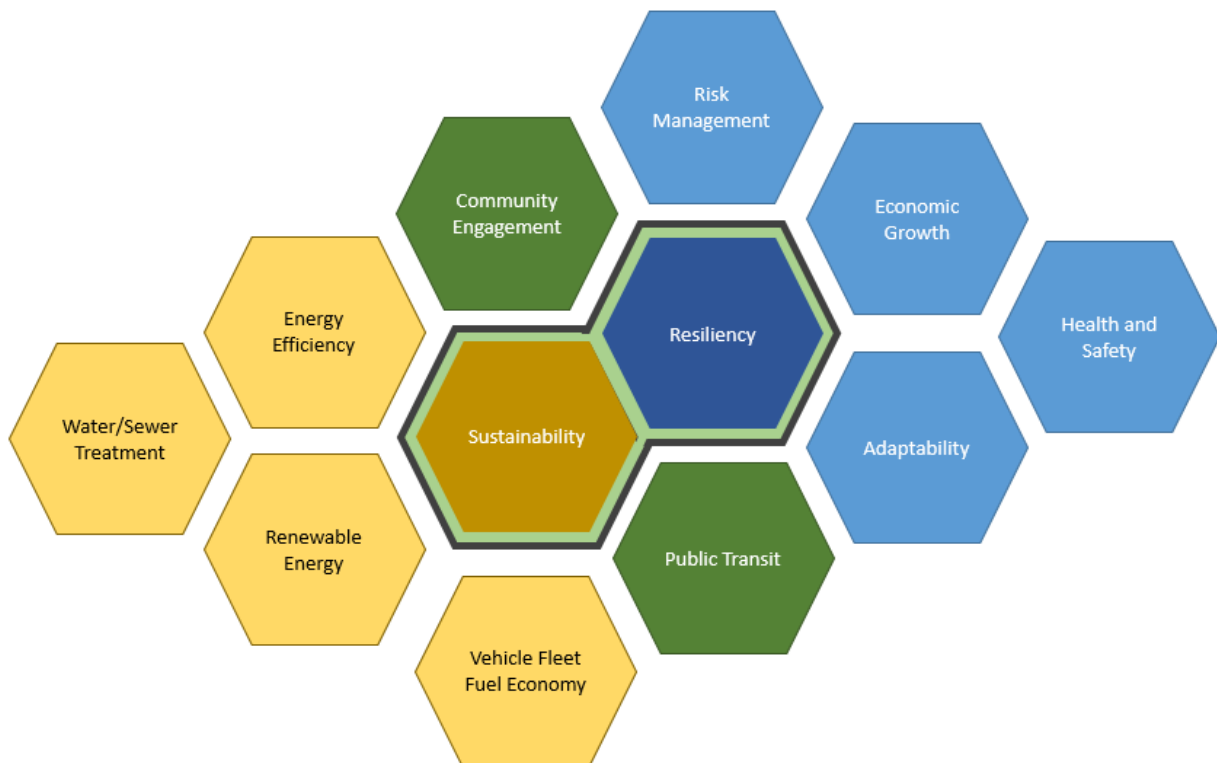
The very first step in achieving a lofty renewable energy goal, such as the City of Rochester's, is to first and foremost reduce current energy consumption as much as possible to make renewable energy achievable. The benefits here are twofold. First, the city is able to realize energy cost savings through energy efficiency projects freeing up additional funds to tackle sustainability projects. Secondly, by reducing overall energy consumption you are reducing the demand placed on the renewable energy portfolio.

The city's building portfolio is very diverse in terms of age, type, and usage. It includes a variety of municipal buildings ranging from fire stations to civic centers totaling over 2 million square feet. The city's total average annual energy consumption is over 200,000MBtu since 2012 in the 17 main municipal buildings that the city tracks via the B3 Benchmarking dashboard.

<sup>1</sup> Summary of the Energy Action Plan Decision Points Agreed at the Rochester Energy Commission Workshop Portion of the Tuesday, August 11th 2015 Meeting

### 2.2.3. A Sustainable and Resilient Future

Rochester is expected to see increases of over 50,000 new jobs and citizens by 2040. This is significant growth for the city, and is being addressed by both the Comprehensive Plan and the Destination Medical Center initiative. By not only acknowledging, but embracing and acting upon the changing future of energy consumption in America, Rochester has the ability to position themselves to meet and exceed assumed carbon-reduction targets and renewable energy standards while bolstering the local economy. Acting now, ensures that Rochester will have not just a sustainable, but a resilient future in a time of extreme change for both the local and global climate and economy. There is opportunity to capitalize on the clean-energy economy that is emerging in Minnesota and beyond. The state of Minnesota has over 15,000 clean-energy jobs with salaries averaging \$71,000 (the average MN salary is \$51,000), and this sector is growing faster than total state employment.<sup>2</sup> Cities that have positioned themselves as sustainable communities have seen increases in jobs and business activities in related fields. This happens in two ways. First, there can be an influx of clean-energy and renewable focused businesses, and secondly, top corporations take into account these statistics, as they are looking to appeal to a changing millennial workforce who cite sustainable communities as a top priority.<sup>3</sup>



## 3. Benchmarking:

### 3.1. B3

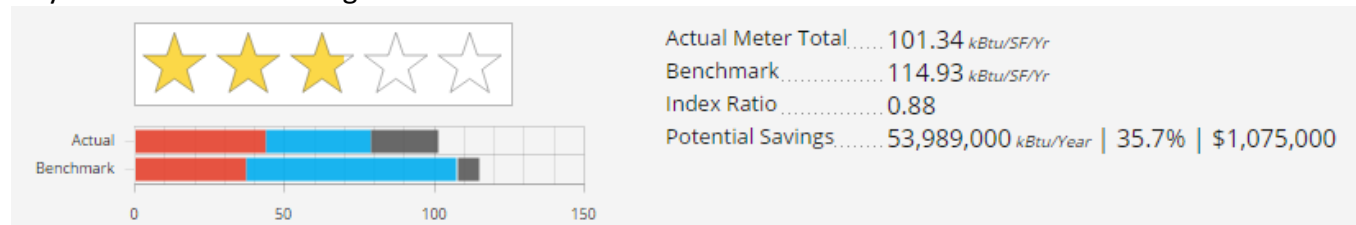
The City of Rochester has been recording energy usage through a Minnesota mandated program called B3. B3 stands for “Buildings, Benchmarks, and Beyond” and is an online tool that uses basic

<sup>2</sup> <http://www.startribune.com/will-steger-in-minnesota-jobs-are-the-newest-sign-of-climate-change/279358642/>

<sup>3</sup> Interview with Cori, Sustainability Coordinator of Dubuque, IA

building and metered data to summarize consumption, costs, and carbon emissions in monthly and annual reports for all Minnesota public buildings.

There are currently 16 buildings, totaling over 1.8 million square feet being tracked by the B3 dashboard with data sating back to 2006. These 17 buildings represent roughly 85% of the city’s total energy usage, and include the Water Reclamation Plant which accounts for roughly 25% of the total energy consumption tracked through B3. The B3 Benchmark is an engineering model that predicts how much energy a site would use if it were built to current energy code, and the B3 rating is a measurement of a site’s actual consumption to its predicted benchmark. Based on B3 predictions, there is potential to save 35.7% on energy consumption and costs which would result in 53,989,000 kBtu/year and \$1.08 million in annual energy savings in these 16 buildings alone. The City of Rochester’s rankings are shown below:



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B3 is currently being managed by the City of Rochester’s finance team, who manually enters in meter data each month from the utility bills. Currently, no departments are actively tracking or monitoring this tool or the data and as a result, there is a lot of untapped potential already available for energy management.

Much of the data is already available to the city, the next hurdle is harnessing the power of this data to make informed decisions, create long-term plans, and make progress towards the City’s aggressive goals.

### Key Takeaways

B3 data is severely under-utilized, it should be monitored monthly and used to identify opportunities

Many of Rochester’s city buildings are inefficient, and lagging behind other MN cities

#### 4. Previous Energy Efficiency Projects:

There have been a number of one-off energy efficiency projects that have been completed by the City of Rochester over the past decade. There are currently no formal ways in which the city is tracking this data, and no comprehensive summary of energy efficient and sustainable projects completed by the city. This is problematic, as there is no efficient way for the city to be able to report on and communicate out the positive impacts that have resulted from these projects, and it is difficult to cite and reference previous project successes in order to make the case for continued investments in additional energy and cost saving projects in the future. Below is a high level summary of a few of the projects researched through this study:

<sup>4</sup> Minnesota B3 Benchmarking Dashboard <https://mn.b3benchmarking.com/Launch>

Project	Date	Partners	Total Project Cost	Rebates	Total Annual \$ Savings	Annual realized \$ Savings	Payback Period	Energy Savings
19-building Johnson Controls Project	2006	Johnson Controls	\$5.6 million	\$308,523	\$605,317	12 Year Positive cash flow \$170,540	18 years, 2006-2018	Actual savings unavailable
Civic Center Parking Garage LED upgrades	2012	?	?	?	\$30,500	?	?	270,000 kWh/year
Fire Station 4 LED lighting upgrade	2016	Fire Department	\$7,937	\$3697	\$3,025	\$3,025	1.48 years	30,660 kwh/year
Rec Center Improvement Project	2017	Industry	\$2.2 million	\$80-95k	\$106,598	\$3,023* *expected to provide \$2.63 million in savings over 25 years	13.9 years	6,159 Mbtu/year
Totals			~\$7.8 million	~\$500,000	\$705,196			

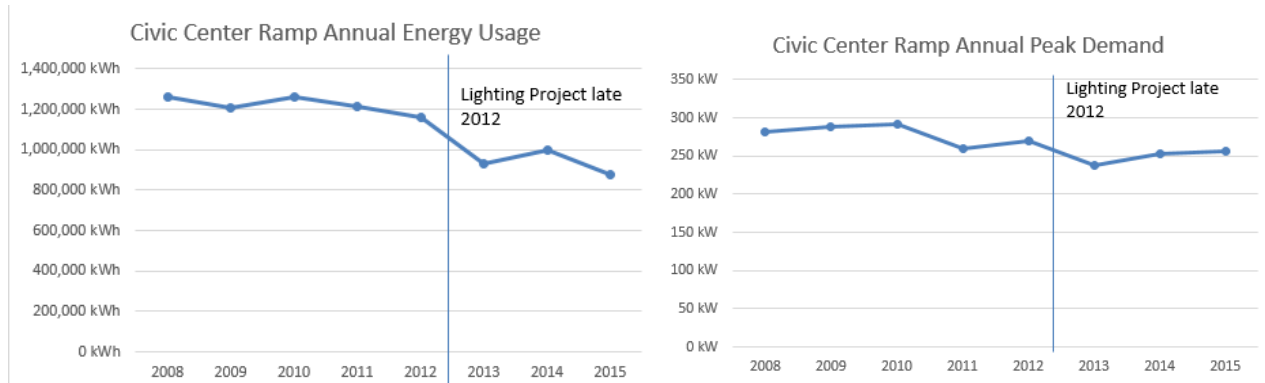
#### 4.1. Johnson Controls 2006

In 2006, the City of Rochester entered into a performance contract for energy efficiency projects with Johnson Controls that spanned 19 city buildings. The Johnson Controls projects spanned a wide range of upgrades from lighting, to insulation improvements, to HVAC system upgrades with a total annual estimated savings of \$605,317 (which includes estimated labor cost savings) and a net project cost of \$5.6 million.

This project has been met with both praise and criticism due to the structuring of the contract with Johnson Controls. Certain individual projects saw unexpected successes, such as the traffic signal LED conversion which resulted in over 80% energy savings while other aspects of the project such as the City Hall actually saw increases in energy usage. The contract guaranteed a certain % of energy savings annually for the entire scope of work, not individual projects. As a result, the total guaranteed energy savings were met even though certain buildings saw little to no decrease in energy usage. It did not appear as though the city implemented any type of retro-commissioning plan or schedule to ensure these net annual savings were being maintained year over year. It is essential to include and maintain a commissioning plan when undergoing energy efficiency projects to ensure savings are realized throughout the life of the project.

#### 4.2. Civic Center Parking Garage 2012

In 2012, the Civic Center Parking Garage underwent an LED retrofit that resulted in a savings of 270,000kwh and ~\$30,500 annually. The average peak demand from 2008-2011 to 2012-2015 dropped 31kWh.



This was an extremely successful project, but due to competing priorities and the complexity of a one-off tracking system, results were not measured for this retrofit consistently. The city has two other public parking ramps that could benefit from an LED lighting upgrade, with similar expected savings that have not yet been budgeted. This provides another example of the risks in not measuring and tracking projects, as there is missed opportunity to roll out on a larger scale.

#### 4.3. Fire Station 4 2016

Fire Station 4 was identified as having exceptionally high electricity usage, and in May of 2016 the fire station completed an LED lighting upgrade throughout the facility. This upgrade was done in-house, which greatly reduced the overall cost of the project. Expected savings for this project are \$3,025 and the payback period is just 1.48 years.



#### 4.4. Rec Center Improvement Project 2016

The City of Rochester, in partnership with the State of Minnesota, hired McInstry to conduct an energy audit of the Rec Center, resulting in a \$2.2 million dollar retrofit project that is expected to save the facility 22.7% in energy annually. This will result in an estimated \$106,598 in energy savings the first year alone which results in a net savings of \$3,023 for the City. The project has a simple payback of 13.9 years, and is expected to provide a net total savings of \$2.63 million over the next 25 years assuming an annual escalation rate of 3.4%.

##### Key Takeaways

EE projects in the past have been handled on an ad-hoc basis with varying results

Little to no short-term financial gains on past energy projects

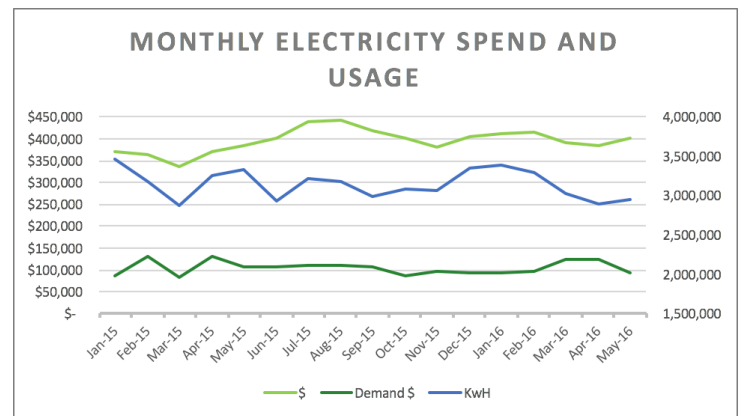
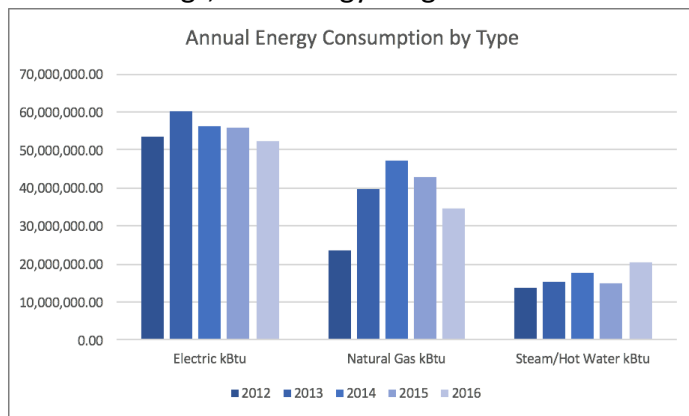
Opportunity to establish best practices and Green Building Codes for City Building projects

Need for in-house expertise and project management

#### 5. Areas of Opportunity:

##### 5.1. Energy Efficiency

Energy efficiency measures are one of the easiest and most effective ways to reduce energy consumption while realizing financial benefits. The City of Rochester spends over \$4million dollars annually on energy, and consumes over 200,000,000 kBtu. The graphs below show that energy usage is down-trending since 2013, but only marginally. This represents a significant opportunity for both cost savings, and energy usage reduction.

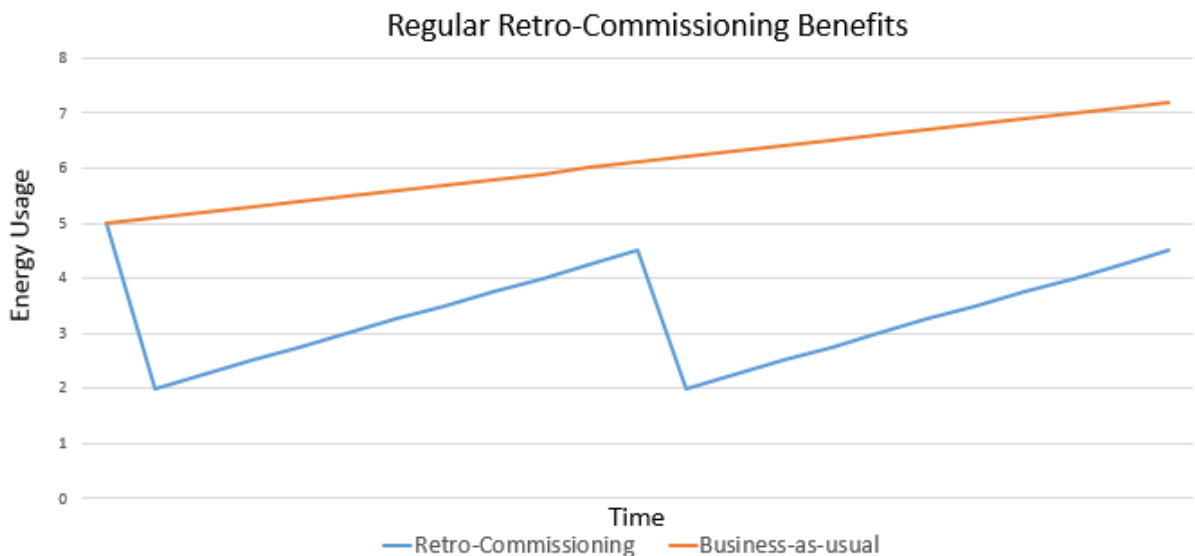


As mentioned previously, the City has completed some energy efficiency projects in the past, however, there is still significant opportunity for improvement in several areas. The below projects highlight just two ways in which the city could reduce energy consumption, and start realizing significant savings on utility bills through recommissioning of existing buildings and LED streetlight conversions.

##### 5.1.1. Recommissioning/Energy Audits

Recommissioning is the term for applying the commissioning process to a building that has been commissioned previously (either during construction or as an existing building); it is normally done every three to five years to maintain top levels building performance and/or after other

stages of the upgrade process to identify new opportunities for improvement.<sup>5</sup> Commissioning is arguably the single-most cost-effective strategy for reducing energy, costs, and greenhouse gas emissions in buildings today. Energy savings tend to persist well over at least a 3- to 5-year timeframe.<sup>6</sup> The average cost is \$0.27 per ft<sup>2</sup> with estimated energy savings of 10-15% and a simple payback period of 0.7 years. Commissioning is more than “just another energy-saving measure”, it is a risk-management strategy that should be integral to any systematic approach to garnering energy savings or emissions reductions. Commissioning ensures that a building owners get what they pay for when constructing or retrofitting buildings, it provides insurance for policymakers and program managers that their initiatives actually meet targets, and it detects and corrects problems that would eventually surface as far more costly maintenance or safety issues.<sup>7</sup>



A survey was conducted with the building managers at 12 sites tracked through B3 Benchmarking. Through this survey it was identified that none of the buildings had been recommissioned, or gone through an energy audit in the last ten years, with exception of the Rec Center which was mentioned previously. The results of the survey highlighted the many opportunities for improved efficiencies, and shed light on the hurdles and obstacles the each building maintenance staff faces when dealing with energy efficiencies in their buildings. A full compilation of the survey can be found in the appendix.

Based on that survey, current projects already underway at the city, and the B3 Benchmarking tool, three City buildings were identified for recommissioning. The buildings chosen were:

- City Hall
  - High Energy Usage Intensity (EUI), as identified through B3 Benchmarking
  - Saw energy usage increase after 2006 Johnson Controls project
  - Has not been recommissioned, or upgraded since 2006

<sup>5</sup> [https://www.energystar.gov/sites/default/files/buildings/tools/EPA BUM\\_CH5\\_RetroComm.pdf](https://www.energystar.gov/sites/default/files/buildings/tools/EPA BUM_CH5_RetroComm.pdf)

<sup>6</sup> <https://extranet.edf.org/climatecorpsresources/Research%20and%20White%20Papers/Building%20Energy%20Systems%20and%20Operations/Retro%20Comissioning/Building%20Commissioning.pdf>

<sup>7</sup> <https://extranet.edf.org/climatecorpsresources/Research%20and%20White%20Papers/Building%20Energy%20Systems%20and%20Operations/Retro%20Comissioning/Building%20Commissioning.pdf>

- MN BioBusiness Center
  - Newer building which is not performing near initial projections for energy usage
- Library
  - High EUI, as identified through B3 Benchmarking
  - Has not been recommissioned, or upgraded since 2006

Integrated Technology Engineering conducted walkthroughs at the buildings, and provided cost estimates for full energy audits, as well as estimated energy savings potential at each of the buildings. This is summarized in the figure found below.

A high-level assessment of opportunity for each of the buildings is provided below:

- City Hall
  - A complete walk-through was unable to be completed prior to the conclusion of the fellowship due to scheduling issues. However, it should be noted that the City Hall is one of the poorest performing buildings in the City's B3 database. City Hall was also found to have energy usage increase after the Johnson Controls project was implemented, this was identified one-year post project completion when the City brought in a third party to verify aspects of the Johnson Controls project. Due to this, it is recommended that the City Hall be evaluated for recommissioning.
- MN BioBusiness Center
  - The building is not operating as it was intended, it is more of as a lab space than an office space, this makes the benchmark data somewhat skewed as labs are more energy intensive than offices. Upon initial inspection, it appears that most of the systems are in place and data needs to be gathered and analyzed, and the building controls need to be modified/re-commissioned. It is estimated that a 10% savings, \$0.27/sqft is reasonable which would put it at around 1.5 year simple payback.
- Library
  - Two main issues were identified, the chiller and the building controls. Both of these are near their end of life, and will require significant capital expenditures. A 15-20% or more savings is easily achievable by switching from a steam to electric chiller. As mentioned, these items will likely need to be replaced in the next 5-10 years, and an energy analysis will help determine if it is more cost effective to replace these ahead of schedule. In addition to these two main upgrades, there are several maintenance / small capital items that could be completed which typically yield paybacks in the range of 2-5 years.

Recommended Projects	Partners	Total Project Cost	Rebates	Total Annual \$ Savings	Annual realized \$ Savings	Payback Period	Energy Savings
Street Light Conversion	Lumeo, RPU	\$2.35 million*  *represents labor and equipment. Does not account for depreciation of assets	N/A	\$360,948	TBD on Contract structure	6.5 years	2.26 million kWh  7,711,440 MBtu
Energy Audit: City Hall	Integrated Technologies	\$2,280	\$250	TBD			
Energy Audit: MN BioBusiness Center	Integrated Technologies	\$3,040	\$250	See below			
Retro-commissioning MN BioBusiness Center	Integrated Technology	\$29,957  Based on estimate of \$0.27/sq foot	TBD	\$21,000*  Based on an estimated 10% improvement	TBD on Contract structure	Estimated 1.5 years	1,188 MBtu  Based on estimated 10% energy Savings
Energy Audit: Library	Integrated Technologies	\$2,280	\$250	See below			
Retro-commissioning Library	Integrated Technology	TBD—further analysis needed	TBD	\$32,882  Based on an estimated 15% improvement	TBD on Contract structure	TBD on total project cost	1,423 MBtu  Based on estimated 15% energy Savings
Totals		~\$2.5 million	TBD on project scope	~\$420,000			

***A step-by-step guide to energy efficiency for buildings can be found [here](#).***

### 5.1.2. Street Lights

The largest opportunity for both energy and cost savings comes from an LED street light conversion. As of December 2015, just 11% of the cities street lights had been converted to LED, leaving an enormous opportunity on the table. Currently, 100 streetlights are being converted each year, at this pace, it will take 77 years for a full LED replacement to occur. Lumeo, a lighting as a service company, was consulted with to provide detail on a full LED conversion for the City of Rochester. Their estimates on cost and savings potential are shown below:

Materials Cost	\$1,803,097
Installation	\$385,200
Sales Tax	\$123,963
<b>Net Project Cost</b>	<b>\$2,312,260*</b>

Annual kWh Savings	2,260,000 kwh
Annual Energy Savings \$	\$360,948
<b>10-year NPV (assuming 4% inflation rate)</b>	<b>\$615,351</b>

\*It is important to note that the Net Project Cost does not account for the cost of depreciated assets that would need to be added to the total project cost. Requests for cost of service, and depreciated asset information have been made, but at the time of this report the information was still unavailable. As a result, the above numbers are not fully reflective of total project costs or NPV of the project, however, annual \$ and kWh savings are accurately represented above.

Next steps will include identification of additional costs due to unpaid depreciation of assets, as well as identification of annual maintenance and labor savings as a result of the LED conversion. Once all necessary data has been made available, analysis can begin to determine the appropriate timeline for an LED street light conversion.

The benefits of an LED conversion go beyond annual energy savings. LED street lights have a useful life of over 5x greater than traditionally street lighting, they reduce light pollution, are easily connected into a city's smart grid, and can be controlled via computer system to brighten or dim as needed leading to even greater savings. It is highly recommended that Rochester begin networking with other cities who have installed LED street lights as early as possible in the process to help confirm the desired objectives and avoid the pitfalls.<sup>8</sup>

Although there will be complications and challenges to overcome with a more aggressive LED conversion, it is believed that the energy and dollars savings will be significant and worth investing the time and effort needed to identify the best path forward for a full conversion.

<sup>8</sup> <http://www.leotek.com/education/documents/Leotek.LED.Streetlight.Guide.V7-101613.pdf>

### **Key Takeaways**

- Largest \$ and energy savings opportunity available to the City
- Strong project management needed to execute (Sustainability Coordinator to drive initiative)
- Close partnership with RPU needed to further build financial case

### **Key Partners:**

RPU

## **5.2. Measurement and Verification Process**

Currently, the city does not have a standardized process in place to measure and track energy efficiency projects. These projects are handled on an ad hoc basis, and while some projects are measured and verified (often times by the consulting firm who was awarded the project) many others are not. By implementing a consistent process to track and measure projects allows the City to better understand the realized benefits of projects from both a cost savings perspective as well as energy reduction. Having access to accurate and reliable data leads to better decision making on future projects, and gives the City accurate numbers to report out to the public to highlight the progress being made. Creating a standard for measurement and verification is imperative to a successful energy management strategy as you cannot manage what you do not measure.

### **5.2.1. International Performance Measurement and Verification Protocol (IPMVP)**

It is recommended that the City of Rochester follow the Measurement and Verification (M&V) specifications provided by the International Performance Measurement and Verification Protocol (IPMVP). IPMVP provides a set of criteria for creating and implementing a project plan to ensure that all aspects of the plan are recorded and properly monitored to ensure realized energy savings. A successful M&V plan is incorporated throughout the project life-cycle for a successful implementation. A full list of the criteria can be found in the appendix.

#### **Purposes of an M&V Plan:**

- A) Increase energy savings:
- B) Document financial transactions:
- C) Enhance financing for efficiency projects
- D) Improve engineering design and facility operations and maintenance
- E) Manage energy budgets
- F) Enhance the value of emission-reduction
- G) Support evaluation of regional efficiency programs
- H) Increase public understanding of energy management as a public policy tool<sup>9</sup>

*Additional information on implementing an M&V plan can be found in the Sustainability Coordinators Toolkit.*

## Key Takeaways

You can not manage what you do not measure

### 5.3. Funding and Financing Opportunities

#### 5.3.1. Green Revolving Fund

Green revolving funds are internal funds that invest in energy efficiency, renewable energy, and other sustainability projects to reduce energy consumption and generate utility cost savings. The savings are then reinvested in future projects. The reason they are called revolving funds is because the funds loan money to specific projects, which then repay the loan through an internal account transfer from savings achieved in the institution's utilities budget.

A GRF must be used to fund projects that reduce resource usage, examples include: lighting upgrades, HVAC system upgrades, boiler and chiller replacements, insulation improvements, water efficient fixtures, etc.

Having a green revolving fund ensures that an institution will always have a source of financing for sustainability projects, thereby building in a system for ongoing savings even in a constrained budget environment.

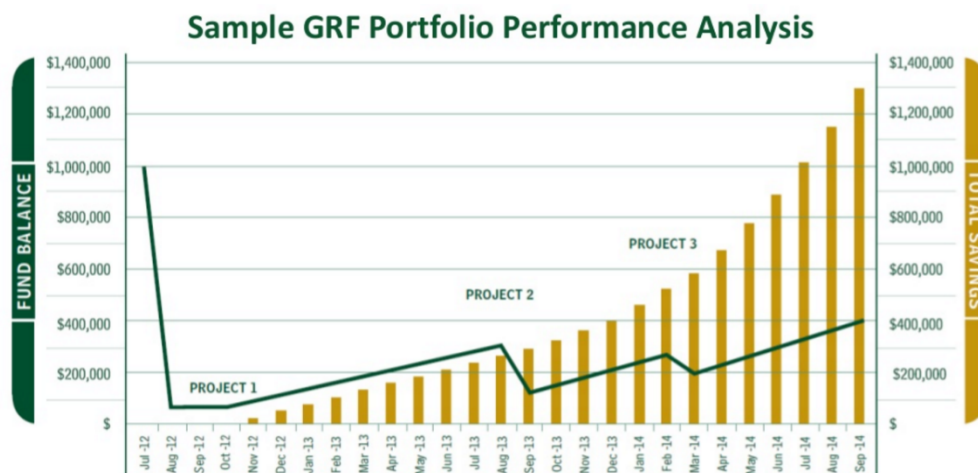


Green Revolving Funds originated in higher education and were made popular by the success seen at Harvard, Dartmouth, and other well-known universities. Although beginning in higher ed institutions, this type of funding is gaining traction in state governments, municipalities, and healthcare facilities.<sup>10</sup> Examples of municipalities with GRF's include the City of Duluth and Asheville, NC, and Dubuque, IA is looking at implementing this within the next few years.

The higher education revolving funds that have been well established for many years have a median annual return of 28%.<sup>11</sup> This is a significant return, and these types of numbers are backed by studies from McKinsey and the Rocky Mountain Institute.

<sup>10</sup> <https://www.greenbiz.com/blog/2013/06/07/are-green-revolving-funds-next-frontier-corporate-energy-efficiency>

<sup>11</sup> <https://www.greenbiz.com/blog/2013/06/07/are-green-revolving-funds-next-frontier-corporate-energy-efficiency>



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#### 5.3.1.1. GRF in Rochester

The GRF should be managed by the Sustainability Coordinator with guidance from the Rochester Energy Commission. Benefits of the GRF for the City of Rochester include a more programmatic approach to sustainability investments, rather than the one-off projects that have occurred in the past. It also signals the City's commitment to sustainability and acts as a catalyst to the cultural shifts needed to achieve the goals set by the City and the Energy Action Plan. One of the major benefits the city will realize from a fund such as this is the ability to track and measure performance of all energy efficiency projects in a consistent and clear manner. More about tracking can be found in the Measurement and Verification section of this document.

Seed money for the creation of the GRF could be funded in a variety of ways. Options include foundation grants, general fund allocation, utility rebate checks, or through grants. For those interested in learning more about developing a GRF, a full guide can be found [here](#). This will answer critical financial questions such as seeding the fund, structuring the GRF, and managerial and operational questions.

A full implementation guide for GRFs can be found [here](#), and is provided in the Sustainability Officer Toolkit as well.

#### 5.3.2. GRITS

If a Green Revolving Fund is implemented at the City of Rochester, it is recommended that the city utilize the ["Green Revolving Investment Tracking System" 1.5 \(GRITS\)](#), developed by the Sustainable Endowments Institute (SEI) for the Billion Dollar Green Challenge. The program was established in 2011 to encourage colleges, municipalities, and other non-profits to invest a total of \$1 billion in green revolving funds to finance energy efficiency projects. This is a nominal fee-based service that has been designed to help institutions better manage and analyze project-level energy, financial, and carbon data. The tool allows you to track performance, calculate payback periods and ROIs for a variety of projects including energy, waste, and water.<sup>13</sup> GRITS allows you to choose the IPMVP Option most appropriate for each project. Additional benefits

<sup>12</sup> <http://www.slideshare.net/joeofiowa/advanced-strategies-test-2>

<sup>13</sup> <http://greenbillion.org/grits/#track-project-savings>



of joining the Billion Dollar Green Challenge include consulting services through SEI experts who have knowledge in developing charter documents, fund proposals, and project guidelines. There is also support for your staff through resources, webinars, and conferences.

### 5.3.3. Grants/Loans/Rebates

Rochester is missing out on a large pool of money in the form of grants and specialty loans. Each year, millions of dollars are available for sustainability and energy related projects, but securing these funds requires someone familiar with the grant writing process, and time available to dedicate to finding opportunities and executing the projects once funds are allocated. Many of these grants require that there be a Sustainability Coordinator on staff to even qualify. The list below provides a snapshot of just a few of the 2016 grants available to the City.

Title	Description	Due Date
<b><u>Public Entity Energy Audit and Renewable Energy Feasibility Study Loan Program</u></b>	This loan program offers low-cost loans to public entities seeking to complete an energy audit or a renewable energy feasibility study.	2020
<b>CERTS Seed Grants</b>	The Minnesota CERTs seeks applications for energy efficiency and/or renewable energy projects requiring technical assistance.	Oct 2016
<b>Partners for Places Fund</b>	Supports collaborations between a city and a local funder to build stronger relationships across sectors and support adoption of innovations in urban sustainability	Rolling
<b>MN Clean Diesel Grants</b>	The Minnesota Pollution Control Agency (MPCA) will be offering its largest clean diesel grant funding amount in five years. Awards are expected to be ~\$50,000	Fall 2016
<b>Cities Leading through Energy Analysis and Planning (Cities-LEAP)</b>	Intends to solicit applications to advance data-driven decision-making by local governments in support of their climate and energy goals.	Nov 2016
<b>Congestion Mitigation and Air Quality Improvement (CMAQ) Program</b>	Transit system capital expansion and improvements to increase ridership; travel demand management strategies; pedestrian and bicycle facilities and promo activities that encourage bicycle commuting.	Fall 2016
<b>Bus and Bus Facilities Program</b>	Provides capital assistance for new and replacement buses, related equipment, and facilities.	Ongoing
<b>Revolving Loan Fund (RLF) Grant Program</b>	These grants of up to \$1 million provide funding to capitalize a revolving loan fund.	Ongoing
<b>Scaling up the Next Generation of Building Efficiency Packages</b>	The Office of Energy Efficiency and Renewable Energy (EERE) intends to issue a Funding Opportunity Announcement.	Oct 2016

### **Key Takeaways**

There is money on the table to help finance many initiatives

Need staff person dedicated to the process

Green Revolving Funds provide a unique funding mechanism for energy efficiency

## **6. Sustainability Officer:**

### **6.1. Identifying the Need**

There is an environmental, social, and local need for an increased focus on sustainability and energy management in the City of Rochester. Throughout this report, areas of opportunity have been identified, City goals and aspirations have been stated, and tools and resources available have been presented. There is a clearly defined path to achieving many of these goals, and creating a more sustainable community in Rochester. However, the missing piece needed to move many of these ideas forward is a dedicated staff person who is able to identify, plan, manage, and execute the projects. In order for Rochester to make progress on their sustainability and energy goals, they need to hire a Sustainability Coordinator who can devote the time and resources needed to this task.

### **6.2. Benefits**

A Sustainability Coordinator will help define the path to achieve the City's 2031 renewable energy and MN Next Gen Goals, implement the Energy Action Plan, and act as a liaison for the Rochester Energy Commission and other public advocacy groups. Having a strategy and an action plan is insufficient without the ability to implement and execute upon them. That is where most organizations fail, and currently, Rochester is not set up to execute upon this plan as there is no central office, or dedicated staff to devote to these kinds of implementation plans and energy efficiency projects.

The major benefits of hiring a full-time Sustainability Coordinator include:

- Provides holistic management for Energy Efficiency and Sustainability projects
- Ability to connect teams and departments and identify synergies
- Manage funding and financing
- Provide in-house expertise
  - Able to advise and make informed decisions
  - Build and develop green building codes for City owned buildings
- Point person for concerned parties
  - Rochester Energy Commission
  - Community groups
  - Energy Integration Committee (DMC related coordination group)
- Information Management
  - Within the community and from other Sustainability Offices peer-networking
- Managing Rochester's participation in initiatives and exchanges
- Manage sustainability outreach and communications

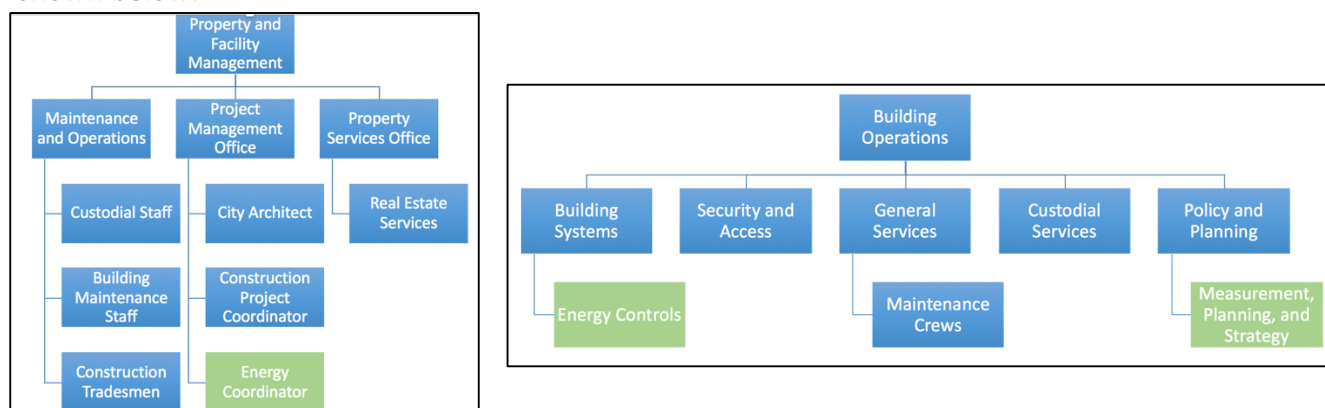
### 6.3. The Position:

There are two major ways in which this position could be structured within the City. Each city that was consulted falls within one of these two frameworks, however, reporting structures vary slightly depending on the goals of the City and areas of impact anticipated.

#### Option 1:

Energy Coordinator housed within a Facilities Management Department or Team.

In this type of position, the Coordinator is much more internally focused on City operations and buildings, and specializes in energy. There is significant benefit to this position, including the expertise they provide. In order for this position to be successful, the city needs to have a designated Facilities and Property Management Department/Team that oversees the building operations for all sites in the city's portfolio. Examples of this structure seen in Duluth, MN and Olmsted County are shown below:



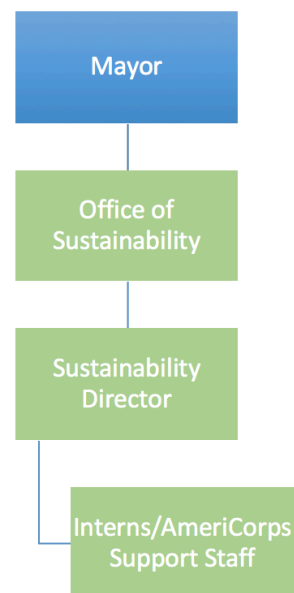
The City of Rochester is not structured appropriately to benefit from an Energy Coordinator as each individual building is managed by a different facility team. Although out of the scope of this report, it is highly recommended that the City consider a restructuring of their organization to increase efficiencies, and develop expertise and best practices for facility maintenance and energy management.

#### Option 2:

Sustainability Coordinator housed outside of any one department, found in either the Mayor's or Administrator's Office

In this structure, the Sustainability Coordinator has a much wider scope that looks beyond energy and can include transportation, air water and environmental quality issues, waste management and recycling initiatives, native plants and animals, community engagement and communications, etc. The issue areas this Coordinator manages depends upon the goals and interests of the City and community. Examples of this type of reporting structure can be found in St. Paul and Dubuque, IA.

The benefits of this type of structure is the ability to work cross departmentally and to help imbed sustainability and efficiency into the decision making of all departments. This position helps to break down departmental silos and identify synergies that may exist to accomplish goals. Another benefit of this structure is that the Coordinator is able to work on both internally facing City issues, such as City owned building efficiencies and employee engagement, as well as community wide engagement strategies. As many of the action items in the Energy Action Plan are both internal and externally facing, the Sustainability Coordinator position would be better suited to implement the EAP than an Energy Coordinator position.



## 6.4. Funding the Position

### 6.4.1. Full Time Staff

It is recommended that the City of Rochester hire a full-time Sustainability Coordinator and fund this position through a combination of grants and general funds. There are several grant opportunities available that can be used to fund a portion of the salary. On average, the City could expect to cover 10-15% of the Sustainability Coordinators salary through this type of funding source. Finding and securing this funding would be the responsibility of the Sustainability Coordinator each year. The remaining portion of the salary would then come from the City's general funds. A breakdown of the estimated costs, grant funding, and necessary energy avoidance needed to fund the position can be found below.

Position	Salary + Benefits Package	Less 10% Grant Funding	% Energy Cost Avoidance to Breakeven
Sustainability Coordinator	\$110,500*	\$11,050	2.49%**

\*Based on USDN average salary \$85,000+30%benefit package

\*\*Based on 2015 energy spend of \$4 million on 17 B3 tracked buildings

It is anticipated that this position could be self-funded from annual energy savings realized from the numerous projects that the Coordinator would identify and implement.

### 6.4.2. MN Green Corps/AmeriCorps

One option for funding additional support staff for the Sustainability Coordinator would be to apply for MN Green Corps volunteers. This is a great option as it gives the Sustainability Coordinator much needed support staff who are able to focus on task specific execution work and delivering on the Sustainability Officer's strategy and vision for the City. There are several examples of communities who use this model including Dubuque, IA who has five AmeriCorps members supporting their Sustainability Office.

Launched in 2009, Minnesota GreenCorps is a statewide program to help preserve and protect Minnesota's environment while training a new generation of environmental professionals. This

program places AmeriCorps members with local governments, educational institutions, and non-profit organizations around Minnesota, where they will serve for 11 months on focused environmental projects that help build community resilience. The program is coordinated by the Minnesota Pollution Control Agency. Minnesota GreenCorps is an AmeriCorps program. Funding is provided through a grant from Serve Minnesota and the Corporation for National and Community Service.

#### **6.5. Role and Responsibilities**

The Sustainability Coordinator role can and will vary as the position evolves within the City of Rochester. The flexibility of this role is considered to be one of its greatest assets, as the Coordinator is able to focus on the City's most pressing issues and address areas of greatest concern from energy management to localized air pollution and beyond. Additional information regarding the proposed evolution of this position in Rochester can be found in the corresponding 2016 EDF report.

Project scoping and prioritization will occur in partnership with the Rochester Energy Commission who will act as an advisory board to the Sustainability Coordinator, as well as through coordination with Department Heads. A proposed list of issue areas and projects was compiled through research and interviews conducted with several Sustainability Coordinators from other local cities and can be found below.

		% of GHG Emissions	Task	Time	Responsibility	Partners/Contacts	Expected Outcome
Energy Efficiency and GHG Reduction Tasks	City Buildings	0.2-0.5%	Energy Audits and Retro-commissioning of buildings	5 year cycles Annual re- porting and verification	<ul style="list-style-type: none"> <li>•Oversee long-term planning and re-commissioning schedule</li> <li>•Prompt Facility Managers to schedule maintenance and re-commissioning</li> <li>•Work with Financing to budget for re-commissioning projects</li> </ul>	<ul style="list-style-type: none"> <li>•Facility Managers</li> <li>•Finance</li> </ul>	<ul style="list-style-type: none"> <li>•Increased energy efficiency, 10-15% on average</li> <li>•Better capital investment planning</li> <li>•M&amp;V to ensure savings realized</li> </ul>
			Lighting Upgrades		<ul style="list-style-type: none"> <li>•Identify lighting projects with high NPVs</li> <li>•Create best practices and lighting standards for all City buildings, street and pole lighting, and parks/fields</li> </ul>	<ul style="list-style-type: none"> <li>•Facility Managers</li> </ul>	<ul style="list-style-type: none"> <li>•Increased energy efficiency, 45-55% on average</li> </ul>
			Monitor B3	Monthly, Annual deep dive	<ul style="list-style-type: none"> <li>•Monitor B3 to identify issues and track trends</li> <li>•Use data to track overall city improvements</li> </ul>	<ul style="list-style-type: none"> <li>•Finance Dept.</li> </ul>	<ul style="list-style-type: none"> <li>•Increased awareness will lead to improvements</li> <li>•Able to identify issues quickly, saving money in the long-term</li> </ul>
	Transportation	20% of Total	Public Transit		<ul style="list-style-type: none"> <li>•Increase public transit ridership through community outreach, increasing service options, routes, and frequency</li> <li>•Shift to alternative fuel buses such as CNG /RNG or electric buses</li> </ul>	<ul style="list-style-type: none"> <li>•Transportation dept.</li> </ul>	<ul style="list-style-type: none"> <li>•Reduction in local air pollution</li> <li>•Reduction in fuel expenditures from city buses</li> <li>•Decrease in traffic congestion</li> </ul>
		0.4%	City Vehicles Fleet		<ul style="list-style-type: none"> <li>•Shift to alternative fuel vehicles for city fleet</li> </ul>	<ul style="list-style-type: none"> <li>•Public Works</li> <li>•Parks and Rec</li> <li>•RPD and RFD</li> </ul>	<ul style="list-style-type: none"> <li>•Reduction in fuel expenditures from city fleet</li> <li>Reduction in GHG and Local pollution from diesel</li> </ul>
			Alternative Modes of Transportation		<ul style="list-style-type: none"> <li>•Increase and promote pedestrian and bike trips</li> <li>•Expand ride share programs</li> </ul>	<ul style="list-style-type: none"> <li>•Parks and Rec</li> <li>•Public Works</li> </ul>	<ul style="list-style-type: none"> <li>•Reduction in local air pollution</li> <li>•Decrease in traffic congestion</li> </ul>
	Street Lights		LED Streetlight Conversion	2-3 year project	<ul style="list-style-type: none"> <li>•Oversee the conversion of the city's 8673 streetlights to LED</li> </ul>	<ul style="list-style-type: none"> <li>•RPU</li> <li>•Public Works</li> <li>•Lumeo</li> </ul>	<ul style="list-style-type: none"> <li>•Reduce consumption by ~2.4 million kWh, and \$360,948 annually</li> <li>•Improved lighting quality, reduced light pollution, reduced maintenance costs</li> </ul>
	Renewable Energy		Renewable Energy Procurement	-2031 and beyond	<ul style="list-style-type: none"> <li>•Help define path to 100% renewable energy by 2031</li> </ul>	<ul style="list-style-type: none"> <li>•RPU</li> <li>•3rd party solar for city owned property</li> </ul>	<ul style="list-style-type: none"> <li>•Further reduce energy spend at city facilities through on-site renewable</li> <li>•Offset GHG through renewable energy programs</li> </ul>

		% of GHG Emissions	Task	Time	Responsibility	Partners/Contacts	Expected Outcome
Planning/Community Engagement	Tracking		City Dashboard/ Newsletter	Dashboard — monthly  Newsletter— annually	<ul style="list-style-type: none"> <li>•Manages energy usage database and develops reporting and communication tools for increasing awareness of energy consumption.</li> <li>•Maintain Dashboard on an ongoing basis – monthly validations</li> <li>•Create and distribute annual sustainability report</li> </ul>	•Depts.	<ul style="list-style-type: none"> <li>•Ability to communicate out progress</li> <li>•Engage community members</li> <li>•Benchmark against other communities</li> <li>•Promote sustainability and energy management</li> </ul>
			Measurement, Verification, and Reporting	Annually	<ul style="list-style-type: none"> <li>•Track project's through energy and financial metrics</li> <li>•Maintain project database</li> <li>•Validate project success</li> </ul>	<ul style="list-style-type: none"> <li>•Facility Managers</li> <li>•Finance</li> </ul>	<ul style="list-style-type: none"> <li>•You can not manage what you do not measure!</li> <li>•Imperative for successful energy efficiency program</li> </ul>
	Implementation	100%	Energy Action Plan Implementation	3-5 year implementation	<ul style="list-style-type: none"> <li>•Oversee the implementation of the Rochester Energy Action Plan</li> <li>•Conduct periodic updates of GHG inventories to track progress against goals</li> </ul>	R.E.C.	<ul style="list-style-type: none"> <li>•Reduction in overall GHG emissions</li> <li>•Serve as point person for REC</li> <li>•REC as advisory board</li> </ul>
			Employee and Departmental Engagement	•Every 2 months	<ul style="list-style-type: none"> <li>•Engage employees individually through EEE program</li> <li>•Task departments with identifying more sustainable best practices within their internal organizations to reduce GHG, energy usage, or cost</li> </ul>	City Employees Dept. Heads	<ul style="list-style-type: none"> <li>•Imbed sustainability into decision making progress throughout city operations</li> <li>•Improved efficiencies, cost savings</li> </ul>
	Sustainability Point Person		DMC Contact	Monthly	<ul style="list-style-type: none"> <li>•Serve on the EIC board as representation for the City</li> <li>•Point person for DMC sustainability goals that name "City" as owners and executors</li> </ul>	DMC Board DMC Sustainability Coordinator	<ul style="list-style-type: none"> <li>•Ensure synergy between DMC energy and sustainability plan and City plan</li> <li>•Cross sharing of knowledge and resources</li> <li>•Designated staff to execute against DMC asks</li> </ul>
			Community Engagement Strategic Partner Engagement	As needed	<ul style="list-style-type: none"> <li>•Develop partnerships with local Businesses, DMC, ISD, etc. to collaborate on energy and sustainability projects</li> <li>•Encourage strategic partners to make commitments, and take action on pressing sustainability issues through education and outreach</li> </ul>	<ul style="list-style-type: none"> <li>•School District</li> <li>•DMC</li> <li>•Mayo</li> <li>•Community Members</li> </ul>	<ul style="list-style-type: none"> <li>•The residential and business community makes up over 90% of all GHG emissions, and partnership with them will be key to achieving Rochester's goals of reduced emissions, a move to renewables, and creating a more sustainable community</li> </ul>

## 7. Conclusion

The addition of a full-time Sustainability Coordinator is imperative to the successful creation of a robust sustainability plan for the City including the implementation of the Rochester Energy Action Plan, identification of energy and cost saving efficiency projects, and securing funding through grants and rebates.

The City is currently lacking a point person with the time, resources, or expertise to scope, identify, manage, and implement energy and sustainability focused projects. The projects identified and implemented by the Sustainability Coordinator will benefit the City of Rochester by bolstering the

City's reputation as a sustainable community as well as financially through energy savings and procurement of funding.





# Appendix:

Building	What Building Automation System (BAS) is being used?	How many meters are in your building, and what portion of the facility do they cover?	Do you have an Interval Data Meter (IDM) or access to 15-minute interval data for your building?	Utility Rate pricing/structure for your buildings? Do you, or would you consider a utility peak load curtailment program?	Are there any outstanding operator overrides on your HVAC or lighting systems? What portion of efficiency controls are being controlled manually?	Do you have an energy management system, if so, how are you using the data currently?	Has your building gone through an energy audit? If so, when did that occur and what action was taken?	Do you currently track energy performance of your buildings, specifically after a retrofit or upgrade to measure improvements?	What is your HVAC maintenance schedule, has it recently been recommissioned, and when is the scheduled upgrade?	What are the barriers you face to effectively manage your buildings energy efficiency? Time, resources, tools?
Fire Station #1	Metasys/Johnson Controls	Unknown	No	No - Public Safety Building	No	No	No	Not directly. Have begun department initiative to install LED Lighting.	Initiating a maintenance schedule with vendors	Resources
Fire Station #2	Andover/Paape/Struure Ware	Unknown	No	No - Public Safety Building	No	No	No	Not directly. Have begun department initiative to install LED Lighting.	Looking at Maintenance schedule	Resources
Fire Station #3	None	Unknown	No	No - Public Safety Building	No	No	No	Not directly. Have begun department initiative to install LED Lighting.	No	Resources
Fire Station #4	Metasys/Johnson Controls	Unknown	No	No - Public Safety Building	No	No	No	LED Lighting installed May 2016	No, being considered	Resources
Fire Station #5	Andover/Paape/Struure Ware	Unknown	No	No - Public Safety Building	No	No	No	Not directly. Have begun department initiative to install LED Lighting.	No	Resources
Graham Arena	Johnson Controls	4	No	No, but would consider it	No	No	Yes Johnson Controls 2006	No	Johnson Controls	Automation, We do not have updated tools or resources to monitor and manage facilities
Library	Metasys/Johnson Controls	1 steam, 1 electric	DIM in the server room and the wire room.	Our current cooling and heating is steam based. We would consider a utility peak load curtailment program	No. Approximately 25%.	Metasys Building Automation System. The software and hardware need to be upgraded.	RPL was part of the City Wide Energy Audit conducted by Johnson Controls in 2005. Lighting fixtures were upgraded, water usage improvements were made and VFDs installed on hot water pumps and cooling	We currently do not have the resources to track this.	Our chiller is under an annual service contract that entails 3 site visits (startup, mid-season and shut down). A Chiller upgrade is needed in the very near future.	Outdated equipment, more resources needed etc.
Public Works TOB	Metasys/Johnson Controls	1 electric, 1 natural gas	No	Normal, we do not use curtailment but are interested	Yes, 25%	Yes, we recently developed an energy management team and received an audit in fall of 2014	Yes, 10/14/2014. New boilers, lighting upgrades, occupancy sensors	Limited	Quarterly - strong interest in recommissioning	No barriers, we are making progress
Public Works TOC	Auto Matrix	4 electric, 5 natural gas	No	Normal, we do not use curtailment but are interested	Yes, None	Yes, we recently developed an energy management team and received an audit in fall of 2015	Yes, 10/12/2015. Installed timer on vacuum system, started replacing inside lighting with LED, Capacitor Bank, and planning several more. Estimated annual savings	Yes	Quarterly - strong interest in recommissioning	No barriers, we are making progress
Rec Center	Andover/Paape	1	Yes	Yes for gas, no for electric	No - Ministry	Ministry will monitor	Yes, March 2016 Ministry	Ministry has submitted a Measurement and Verification plan to the state	Will be upgraded this year	Resources
City Hall	Metasys/Johnson Controls	1 electric, 1 steam	Not Sure	Curtailment would not work as generators are too loud to run during the	Yes, outside air lockouts, stats	Yes, unsure how data is used	Yes, 2006	Not sure	No, nothing scheduled	None
MN BioBusiness Center	American Auto Matrix	1 gas meter, 1 electric, limited sub meter	No	Would consider if it does not interfere with building systems	all systems automated	na?	building engineers have been aware of energy consumption issues	B3 only	Chiller system, boiler system	initial building design

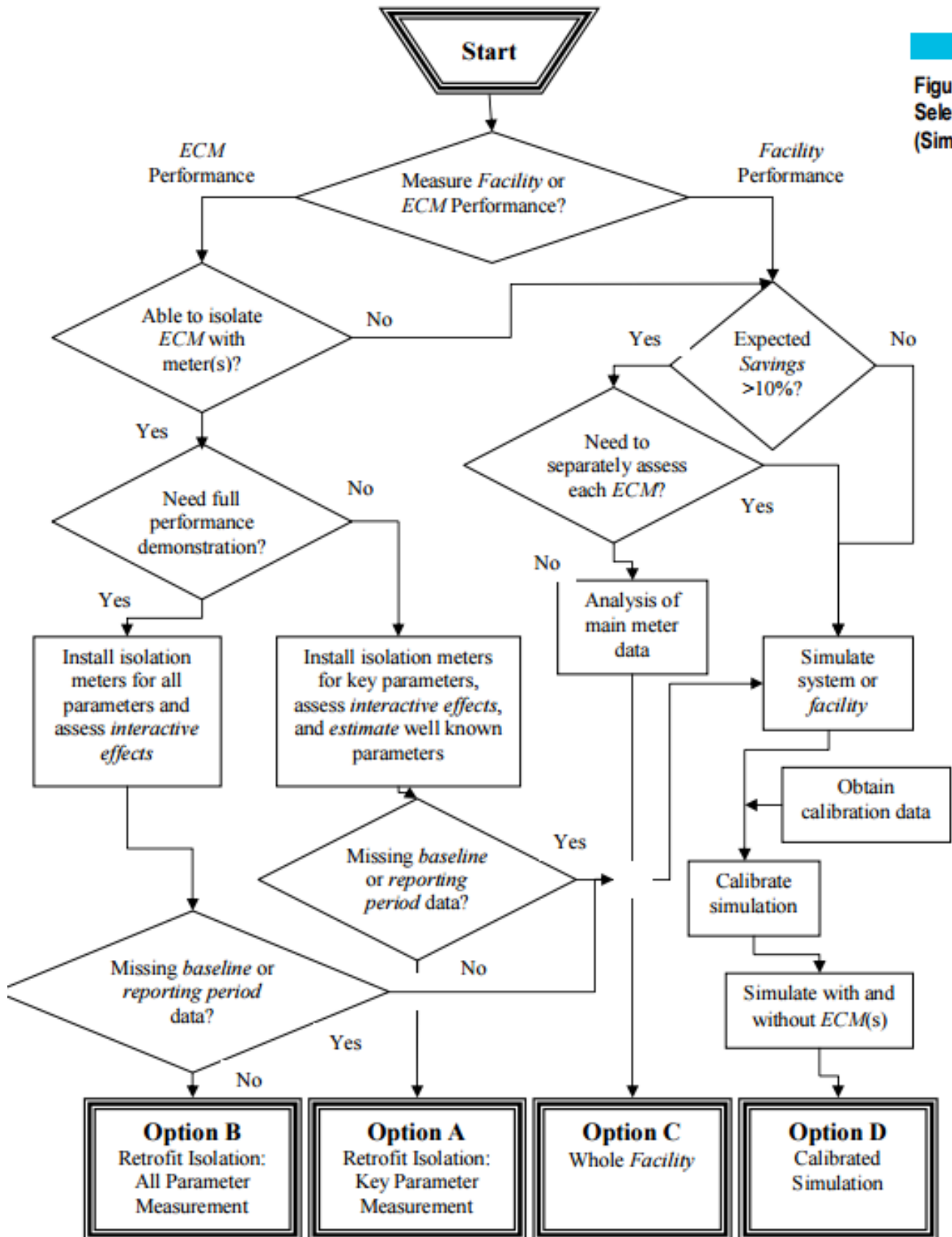


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### **Purposes of an M&V Plan:**

- I) **Increase energy savings:** Accurate determination of energy savings gives facility owners and manager's valuable feedback on their energy conservation measures (ECMs). This feedback helps them adjust ECM design or operations to improve savings, achieve greater persistence of savings over time, and lower variations in savings (Kats et al. 1997 and 1999, Haberl et al. 1996).
- J) **Document financial transactions:** For some projects, the energy efficiency savings are the basis for performance-based financial payments and/or a guarantee in a performance contract. A well-defined and implemented M&V Plan can be the basis for documenting performance in a transparent manner and subjected to independent verification.
- K) **Enhance financing for efficiency projects:** A good M&V Plan increases the transparency and credibility of reports on the outcome of efficiency investments. It also increases the credibility of projections for the outcome of efficiency investments. This credibility can increase the confidence that investors and sponsors have in energy efficiency projects, enhancing their chances of being financed.
- L) **Improve engineering design and facility operations and maintenance:** The preparation of a good M&V Plan encourages comprehensive project design by including all M&V costs in the project's economics. Good M&V also helps managers discover and reduce maintenance and operating problems, so they can run facilities more effectively. Good M&V also provides feedback for future project designs.
- M) **Manage energy budgets:** Even where savings are not planned, M&V techniques help managers evaluate and manage energy usage to account for variances from budgets. M&V techniques are used to adjust for changing facility-operating conditions in order to set proper budgets and account for budget variances.
- N) **Enhance the value of emission-reduction credits** Accounting for emission reductions provides additional value to efficiency projects. Use of an M&V Plan for determining energy savings improves emissions-reduction reports compared to reports with no M&V Plan.
- O) **Support evaluation of regional efficiency programs** Utility or government programs for managing the usage of an energy supply system can use M&V techniques to evaluate the savings at selected energy user facilities. Using statistical techniques and other assumptions, the savings determined by M&V activities at selected individual facilities can help predict savings at unmeasured sites in order to report the performance of the entire program.
- P) **Increase public understanding of energy management as a public policy tool** By improving the credibility of energy management projects, M&V increases public acceptance of the related emission reduction. Such public acceptance encourages investment in energy efficiency projects or the emission credits they may create. By enhancing savings, good M&V practice highlights the public benefits provided by good energy management, such as improved community health, reduced environmental degradation, and increased employment<sup>14</sup>

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<sup>14</sup> <http://evo-world.org/en/library-mainmenu/download-protocol-documents-mainmenu-en/volume-i-2012/1543-2012-ipmvp-volume-i-in-english-27-20/file>

IPMVP Option	How Savings Are Calculated	Typical Applications
<p><b>A. Retrofit Isolation: Key Parameter Measurement</b></p> <p>Savings are determined by field measurement of the key performance parameter(s) which define the <i>energy</i> use of the ECM's affected system(s) and/or the success of the project.</p> <p>Measurement frequency ranges from short-term to continuous, depending on the expected variations in the measured parameter, and the length of the <i>reporting period</i>.</p> <p>Parameters not selected for field measurement are <i>estimated</i>. Estimates can be based on historical data, manufacturer's specifications, or engineering judgment. Documentation of the source or justification of the <i>estimated</i> parameter is required. The plausible savings error arising from estimation rather than measurement is evaluated.</p>	<p>Engineering calculation of <i>baseline</i> and <i>reporting period energy</i> from:</p> <ul style="list-style-type: none"> <li>o short-term or continuous measurements of key operating parameter(s); and</li> <li>o <i>estimated</i> values.</li> </ul> <p><i>Routine</i> and <i>non-routine adjustments</i> as required.</p>	<p>A lighting retrofit where power draw is the key performance parameter that is measured periodically. Estimate operating hours of the lights based on facility schedules and occupant behavior.</p>
<p><b>B. Retrofit Isolation: All Parameter Measurement</b></p> <p>Savings are determined by field measurement of the <i>energy</i> use of the ECM-affected system.</p> <p>Measurement frequency ranges from short-term to continuous, depending on the expected variations in the savings and the length of the <i>reporting period</i>.</p>	<p>Short-term or continuous measurements of <i>baseline</i> and <i>reporting-period energy</i>, and/or engineering computations using measurements of proxies of <i>energy</i> use.</p> <p>Routine and non-routine adjustments as required.</p>	<p>Application of a variable-speed drive and controls to a motor to adjust pump flow. Measure electric power with a kW meter installed on the electrical supply to the motor, which reads the power every minute. In the <i>baseline period</i> this meter is in place for a week to verify <i>constant</i> loading. The meter is in place throughout the <i>reporting period</i> to track variations in power use.</p>
<p><b>C. Whole Facility</b></p> <p>Savings are determined by measuring energy use at the whole facility or sub-facility level.</p> <p>Continuous measurements of the entire facility's <i>energy</i> use are taken throughout the <i>reporting period</i>.</p>	<p>Analysis of whole facility <i>baseline</i> and <i>reporting period</i> (utility) meter data.</p> <p><i>Routine adjustments</i> as required, using techniques such as simple comparison or regression analysis.</p> <p><i>Non-routine adjustments</i> as required.</p>	<p>Multifaceted energy management program affecting many systems in a facility. Measure energy use with the gas and electric utility meters for a twelve month <i>baseline period</i> and throughout the <i>reporting period</i>.</p>
<p><b>D. Calibrated Simulation</b></p> <p>Savings are determined through simulation of the <i>energy</i> use of the whole facility, or of a sub-facility.</p> <p>Simulation routines are demonstrated to adequately model actual <i>energy</i> performance measured in the facility.</p> <p>This Option usually requires considerable skill in calibrated simulation.</p>	<p>Energy use simulation, calibrated with hourly or monthly utility billing data. (Energy end use metering may be used to help refine input data.)</p>	<p>Multifaceted energy management program affecting many systems in a facility but where no meter existed in the <i>baseline period</i>.</p> <p>Energy use measurements, after installation of gas and electric meters, are used to calibrate a simulation.</p> <p><i>Baseline</i> energy use, determined using the calibrated simulation, is compared to a simulation of <i>reporting period energy</i> use.</p>